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Evaluation #

New Product # 20089013
Replaces # 200813-O

Safety & Buildings Division
201 West Washington Avenue
P.O. Box 2658
Madison, WI 53701-2658

Wisconsin Building Products Evaluation

Material: Best Management Standards for Foundation Repair

Manufacturer: Wisconsin Association of Foundation Repair Professionals (WAFRP)

SCOPE OF EVALUATION

GENERAL: This report evaluates the Best Management Standards for Foundation Repair for compliance with the requirements of the current edition of the Wisconsin Uniform Dwelling Code for 1- and 2-family dwellings and the current edition of the Wisconsin Enrolled Commercial Building Code.

The Standards were prepared specifically for the Wisconsin Association of Foundation Repair Professionals (WAFRP) in cooperation with the Building Inspectors Association of Southeastern Wisconsin to address various conditions and foundation repair standards.

The **Comm** requirements below in accordance with the current **Wisconsin Uniform Dwelling Code for 1- and 2-family dwellings:**

- **Soil Lateral Loads:** The engineered foundation products were evaluated in accordance with the foundation requirements of **s. Comm 21.18(1)(c).**
- **Masonry Foundation Walls:** The engineered foundation products were evaluated in accordance with the structural requirements of **s. Comm 21.18(3)(b).**
- **Floor Design:** The engineered foundation products were evaluated in accordance with the floor design requirements of **s. Comm 21.19.**
- **Concrete Floors:** The engineered foundation products were evaluated in accordance with the concrete floor requirements of **s. Comm 21.20.**
- **Precast Concrete Floors:** The engineered foundation products were evaluated in accordance with the precast concrete floor requirements of **s. Comm 21.21.**

The **IBC** requirements below in accordance with the current **Wisconsin Amended ICC Code:**

- **Soil Lateral Loads:** The engineered foundation products were evaluated in accordance with the soil lateral load requirements of **s. IBC 1610.1.**
- **Soils and Foundations:** The engineered foundation products were evaluated in accordance with the soil and foundation requirements of **s. IBC 1801.**
- **Foundation and Soils Investigation:** The engineered foundation products were evaluated in accordance with the foundation and soil investigation requirements of **s. IBC 1802.**
- **Footings and Foundations:** The engineered foundation products were evaluated in accordance with the footing and foundation requirements of **s. IBC 1805.**

- **Anchorage to Concrete—Allowable Stress Design:** The engineered foundation products were evaluated in accordance with the anchorage to concrete—allowable stress design requirements of **s. IBC 1910.1.**
- **Design Methods:** The engineered foundation products were evaluated in accordance with the design method requirements of **s. IBC 2101.2.**
- **Bolting:** The engineered foundation products were evaluated in accordance with the bolting requirements of **s. IBC 2204.2.**
- **Structural Steel:** The engineered foundation products were evaluated in accordance with the structural steel requirements of **s. IBC 2209.1.**
- **Wood:** The engineered foundation products were evaluated in accordance with the general wood requirements of **s. IBC 2301.1.**
- **General Construction Requirements:** The engineered foundation products were evaluated in accordance with the general construction requirements of **s. IBC 2304.**
- **Allowable Stress Design:** The engineered foundation products were evaluated in accordance with the allowable stress requirements of **s. IBC 2306.**
- **Conventional Light-Frame Construction:** The engineered foundation products were evaluated in accordance with the conventional light-frame construction requirements of **s. IBC 2308.**

DESCRIPTION AND USE

The EFP Parts are installed at the top and bottom of each steel wall reinforcing column. The wall reinforcing is located at the on center spacing per engineering specifications located in Table 1.

The EFP Parts are designed to be used with 2 inch wide steel tubes at various depths per engineering standards.

Seismic forces need not be considered for the EFP Parts. This product does not affect the lateral force resisting system of the structure.

ENGINEERED FOUNDATION PRODUCTS (EFP)

Part 1: Saddle Top Connection: This part is a steel saddle that fits around a steel reinforcing tube. The saddle connection has (2) plates that fit on either side of a floor joist. The part is then bolted into place with (2) 5/8" diameter bolts through the steel plates and floor joist and (1) 3/8" diameter lag screw into the bottom of the floor joist.

Part 2: "Z" Top Connection: This part consists of (2) steel plates. One plate is bent into a "Z" shape that fits against a steel reinforcing tube and floor joist. The other piece is a flat plate that sits on the back side of the floor joist. There are triangular teeth that push into the floor joist and holes for (2) 1/2" diameter bolts that bolt through the plates and the floor joist.

Part 3: Bottom Bracket: This part is a steel base plate with a vertical tab that fits into a steel reinforcing tube. There are (2) holes for anchor bolts to go through the base plate and into either a concrete floor slab or footing.

Part 4: Offset Top Connection: This part is an offset extension accessory that is used with the saddle top connection or "Z" top connection when there is an obstruction preventing the placement of the top connection directly against the steel reinforcing tube. The extension is a steel tube that fits into the bottom of the saddle and has a U-shaped bent steel plate on the other end to fit around the basement wall reinforcing tube. The extension tube is held in place with 3/8" diameter lag screws installed through the tube and into the bottom of the floor joist. The top connection is then secured with either a saddle or "Z" connector as described above.

Part 5: Alternate Offset Top Connection: This part is an offset extension accessory that is used with the saddle top connection or "Z" top connection when there is an obstruction at the top of the wall. The extension is an "L" shaped steel tube. The vertical leg of the tube fits into the saddle top connection or a "Z" top connection. The horizontal leg of the tube sits on the top of the wall reinforcing tube. There are (2) 1/4" thick steel plates on either side of the tubes fastening the wall reinforcing tube and the "L" tube with (4) 1/4" TEK screws into both sides of each tube. The top connection is then secured with either a saddle or "Z" connector as described above.

Part 6: Alternate Bottom Bracket: This part is a cast aluminum base plate with a vertical tab that fits into the steel tube. There are (2) holes for anchor bolts to go through the base plate and into either a concrete floor slab or footing.

TESTS AND RESULTS

Wisconsin Testing Laboratories, LLC conducted load tests on engineered foundation products Wall Restraint Top Connector Alternate #1.

Test Results: The test specimen gradually rotated in the plane of loading, and the rotation became noticeable after the 6,500-lb. load level. The test was terminated at about 7,500-lbs. or, twice the design load of the product. After the load test was released, examination of the test specimen revealed that it had remained intact and firmly attached to the joist. The only observable deformation was a change in the angle of attachment between the horizontal attachment plate and the vertical portion of the unit.
Conclusions: The ultimate load capacity of the product is at least twice the design load of 3,750-lbs.

Wisconsin Testing Laboratories, LLC conducted load tests on engineered foundation products Wall Restraint Top Connector Alternate #2.

Test Results: No significant deformation of the test specimen was noted at the 2,500, 5,000 and 6,500 lb. load levels. At about 7,500 lbs. or, twice the design load of the product, the wood joist failed. After the load test was released, examination of the test specimen revealed that it had remained intact, although a noticeable bending had occurred in the steel plate at the ends of the triangular stiffeners. The steel plate on the side holding the tube section had slid down the joist about ¼-inch, while the steel plate on the other side of the joist had not moved.
Conclusions: The ultimate load capacity of the product is at least twice the design load of 3,750-lbs.

Table 1 BASEMENT WALL REINFORCEMENT DESIGN
(Table based on a 90 PCF soil pressure)

WALL HEIGHT* 10 Courses (up to 6' -10'')

STEEL SIZE SPACING and BLOCK SIZE	SINGLE JOIST SIDE MOUNT	DOUBLE JOIST Or 2x8 min. nailed to side of joist	SINGLE JOIST With SADDLE	TJI JOIST
4'' x 2'' x 1/4'' 36'' Max. Spacing 8'', 10'' or 12''	(2) 1" Dia. Bolts See Details 2-5 on S2-A (4) 1/2" Dia. Bolts See Details 2-5 on S2-B	(2) 5/8" Dia. Bolts See Details 10-13 on S4-A	(2) 1/2" Dia. Bolts See Details 18-22 on S6	(2) 1" Dia. Bolts See Details 6-7 on S3-A
5'' x 2'' x 3/16'' 50'' Max. Spacing 10'' or 12''	(4) 5/8" Dia. Bolts See Details 2-5 on S2-B	(2) 3/4" Dia. Bolts See Details 10-13 on S4-B (4) 1/2" Dia. Bolts See Details 10-13 on S4-B	(2) 5/8" Dia. Bolts See Details 18-22 on S6-	(4) 5/8" Dia. Bolts See Details 6-7 on S3-B

WALL HEIGHT 11 Courses (6' -10'' to 7' -6'')

STEEL SIZE SPACING and BLOCK SIZE	SINGLE JOIST SIDE MOUNT	DOUBLE JOIST Or 2x8 min. nailed to side of joist	SINGLE JOIST With SADDLE	TJI JOIST
5'' x 2'' x 3/16'' 36'' Max. Spacing 8'', 10'' or 12''	(2) 1" Dia. Bolts See Details 2-5 on S2-A (4) 1/2" Dia. Bolts See Details 2-5 on S2-B	(2) 5/8" Dia. Bolts See Details 10-13 on S4-A	(2) 5/8" Dia. Bolts See Details 18-22 on S6	(2) 1" Dia. Bolts See Details 6-7 on S3-A
6'' x 2'' x 3/16'' 50'' Max. Spacing 10'' or 12''	(4) 3/4" Dia. Bolts See Details 2-5 on S2-B	(2) 1" Dia. Bolts See Details 10-13 on S4-A (4) 1/2" Dia. Bolts See Details 10-13 on S4-B	(2) 3/4" Dia. Bolts See Details 18-22 on S6-	(4) 3/4" Dia. Bolts See Details 6-7 on S3-B

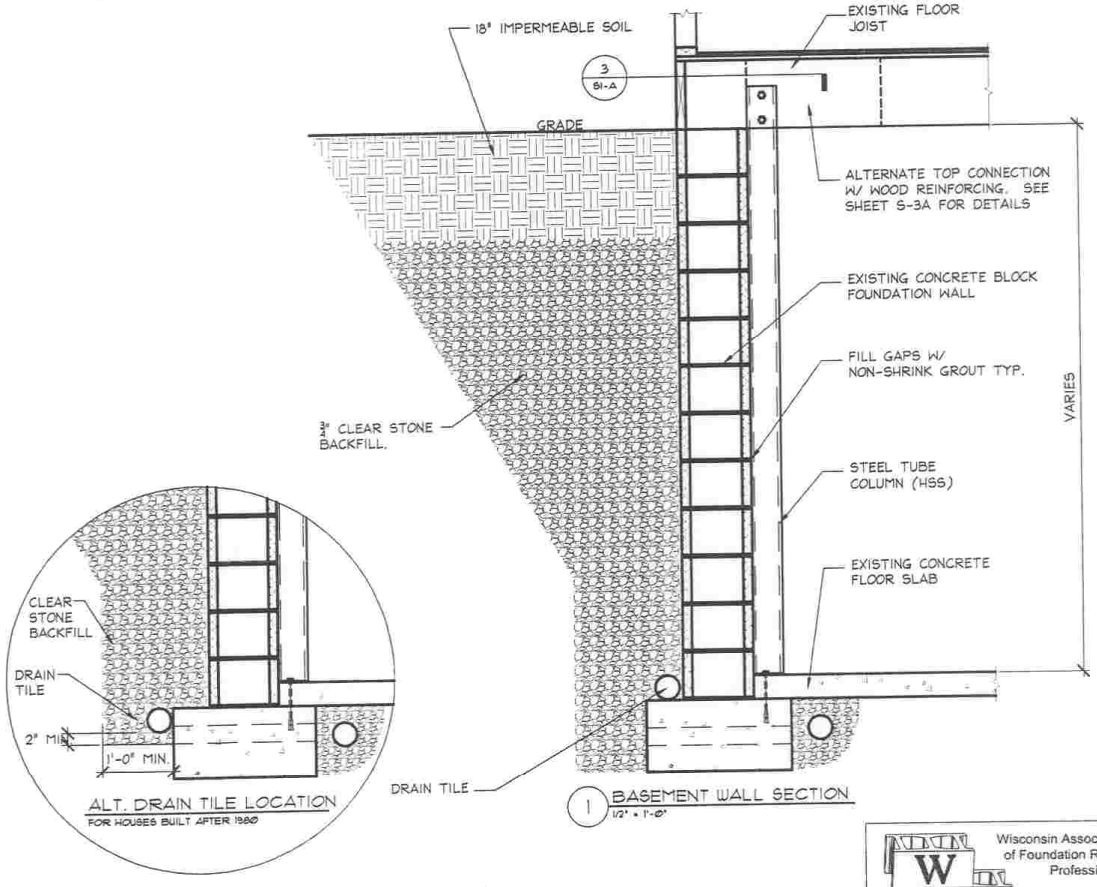
WALL HEIGHT 12 Courses (7' -6''to 8' -2'')

STEEL SIZE SPACING and BLOCK SIZE	SINGLE JOIST SIDE MOUNT	DOUBLE JOIST Or 2x8 min. nailed to side of joist	SINGLE JOIST With SADDLE	TJI JOIST
5'' x 3'' x 1/4'' 36'' Max. Spacing 8'', 10'' or 12''	(4) 5/8" Dia. Bolts See Details 2-5 on S2-A	(2) 3/4" Dia. Bolts See Details 10-13 on S4-B (4) 1/2" Dia. Bolts See Details 10-13 on S4-B	(2) 5/8" Dia. Bolts See Details 18-22 on S6	(4) 5/8" Dia. Bolts See Details 6-7 on S3-B
6'' x 3'' x 1/4'' 50'' Max. Spacing 10'' or 12''	(4) 3/4" Dia. Bolts See Details 2-5 on S2-B	(2) 1" Dia. Bolts See Details 10-13 on S4-B (4) 5/8" Dia. Bolts See Details 10-13 on S4-B	(2) 1" Dia. Bolts See Details 18-22 on S6-	(4) 3/4" Dia. Bolts See Details 6-7 on S3-B

*Wall Height is top of floor to bottom of joist
**Bottom Anchors : Min. (2) 1/2" dia. x 7" long expansion bolts into footing
or (2) 3/4" dia. x 4" long expansion bolts min. 3" into slab

SPECIFICATIONS:

STEEL TUBE WALL REINFORCING @ 36" O.C. MAY BE USED FOR 8", 10", OR 12" BLOCK WALLS.
REINFORCING SPACING CAN BE THE AVERAGE OF TWO ADJACENT SPACES WITH A MAXIMUM SPACING OF 50".
FOR EXAMPLE (5'-0" + 3'-0")/2 = 4'-0" AVERAGE SPACING
STEEL TUBE WALL REINFORCING @ 50" O.C. MAY BE USED FOR 10", OR 12" BLOCK WALLS.
STEEL TUBE MUST HAVE MINIMUM 46KSI YIELD STRENGTH.
STEEL PLATE MUST HAVE 36KSI MINIMUM YIELD STRENGTH.
WELDING TO BE PER ASTM STANDARDS.
PRESTRESSING TUBES IS NOT ALLOWED WITHOUT PROPERLY ENGINEERED GUIDELINES.
REINFORCING GUIDELINES ALSO APPLY TO POURED CONCRETE WALLS OF EQUIVALENT HEIGHT AND THICKNESS.
BOLTS AND SLEEVES TO BE ZINC PLATED CARBON STEEL OR BETTER.
NEW WOOD BLOCKING TO BE DOUG FIR NO.2 OR BETTER.
SCREW TYPE ANCHORS CAN BE USED IN LIEU OF EXPANSION BOLTS IN ALL CASES.
ALL STRUCTURAL CALCULATIONS FOR WOOD MEMBERS PER 2001 NATIONAL DESIGN SPECIFICATIONS FOR WOOD CONSTRUCTION (NDS).



TITLE: 2 Bolt Basement Wall Reinforcing Details	
SHEET: S1-A, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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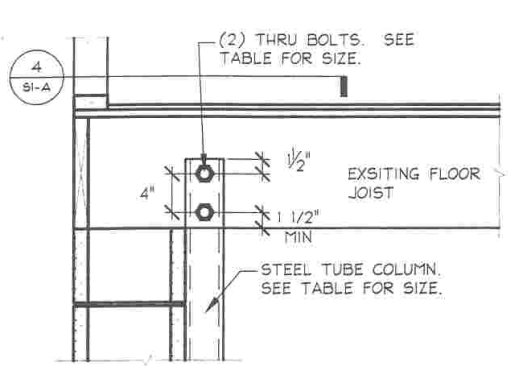
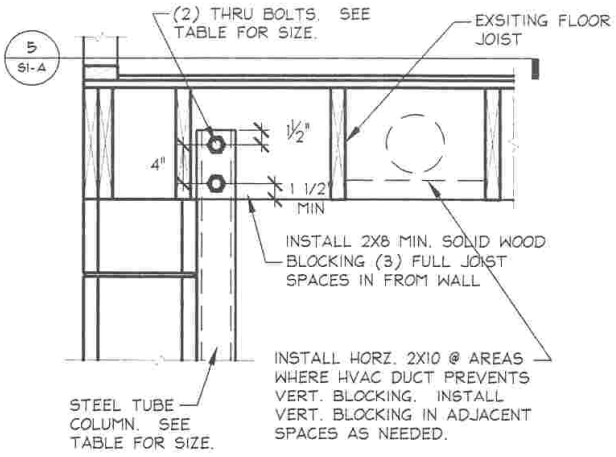
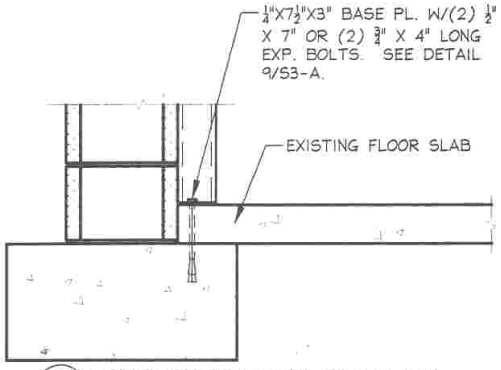
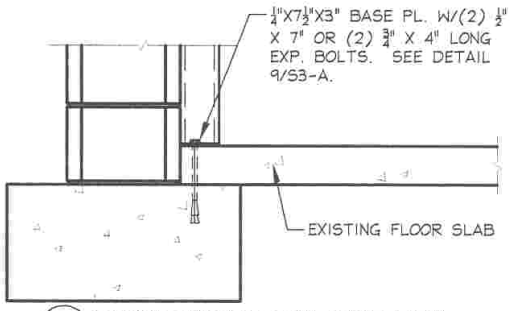


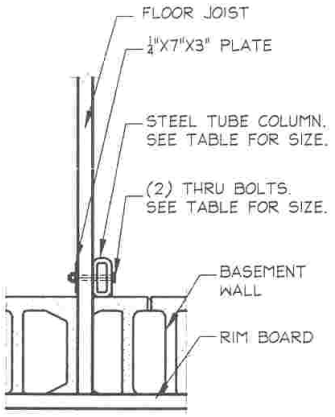




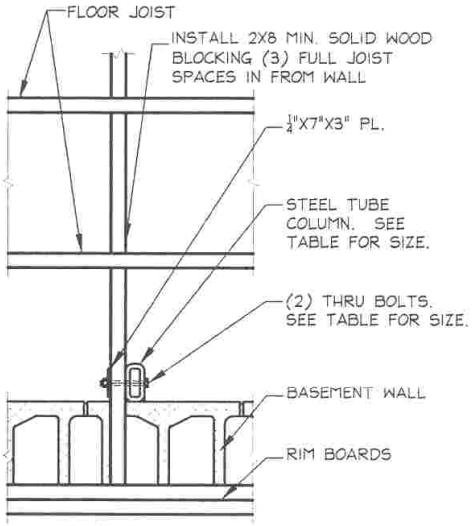
2 CONNECTION DETAIL SIDE VIEW
3/4" = 1'-0"



3 CONNECTION DETAIL SIDE VIEW
3/4" = 1'-0"



4 TOP CONNECTION DETAIL
3/4" = 1'-0"



5 TOP CONNECTION DETAIL
3/4" = 1'-0"

TITLE: 2 Bolt Top & Bottom Connection Details	
SHEET: S2-A, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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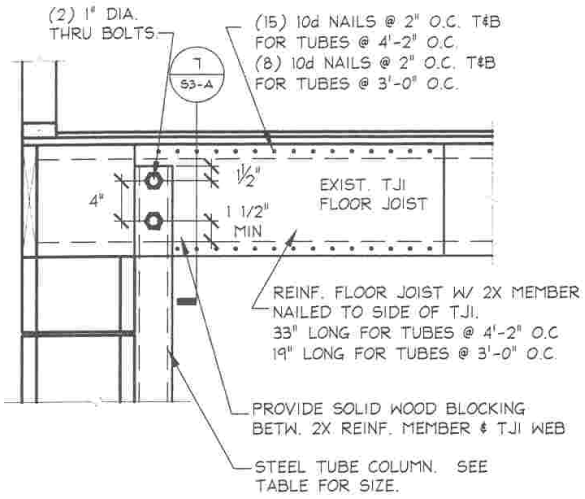
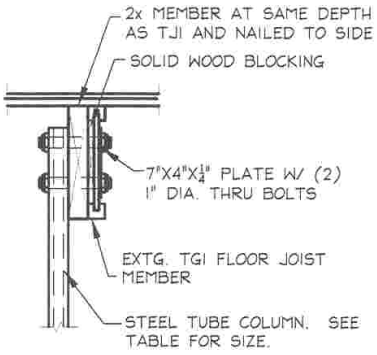
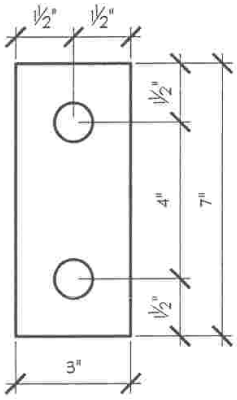


6 TJI CONNECTION DETAIL SIDE VIEW
3/4" = 1'-0"

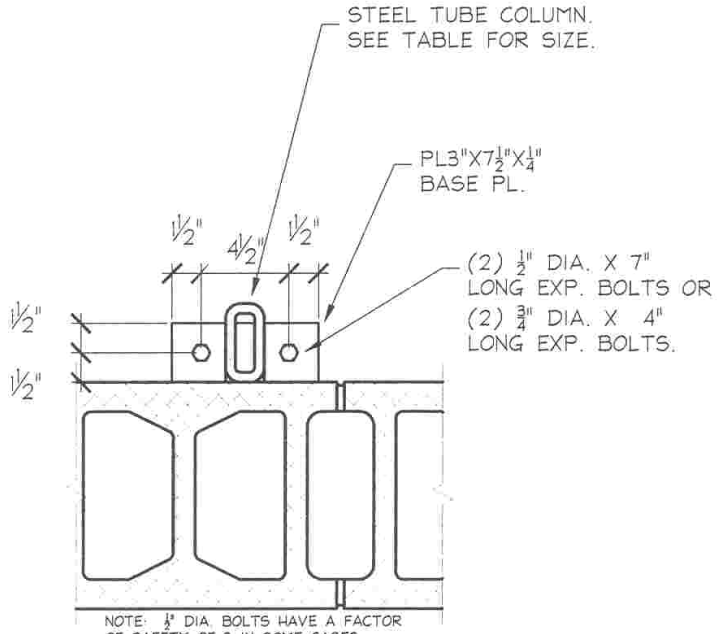


7 TJI CONNECTION DETAIL SECTION
3/4" = 1'-0"



8 TOP PLATE DETAIL
3" = 1'-0"

ALTERNATE:
(2) 1/8" THICK x 2" DIA. WASHERS CAN BE USED IN LIEU OF BACKING PLATE



9 BOTTOM CONN. DETAIL
1 1/2" = 1'-0"

TITLE: 2 Bolt Alt. Top Connection W/ Double Floor Joist	
SHEET: S3-A, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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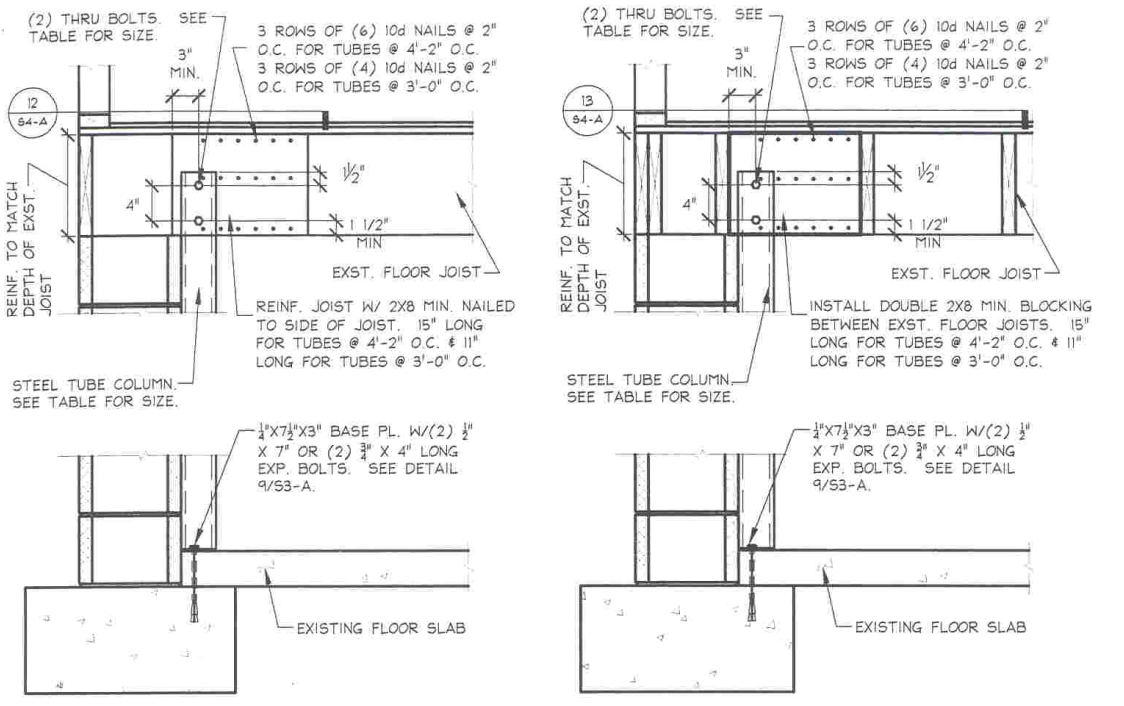

TITLE: 2 Bolt Alt. Top Connection W/ Double Floor Joist	
SHEET: S4-A, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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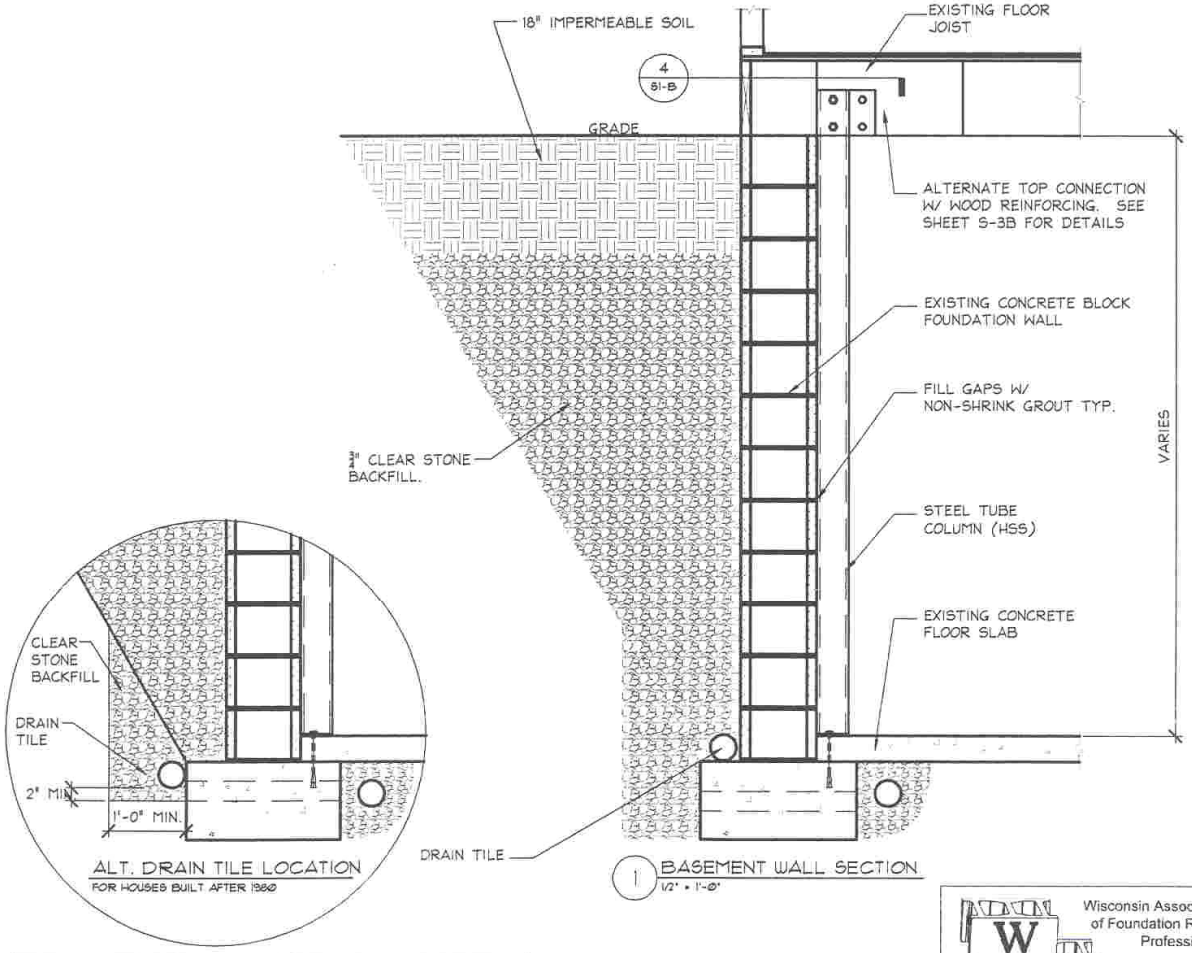

TITLE: 4 Bolt Basement Wall Reinforcing Details	
SHEET: S1-B, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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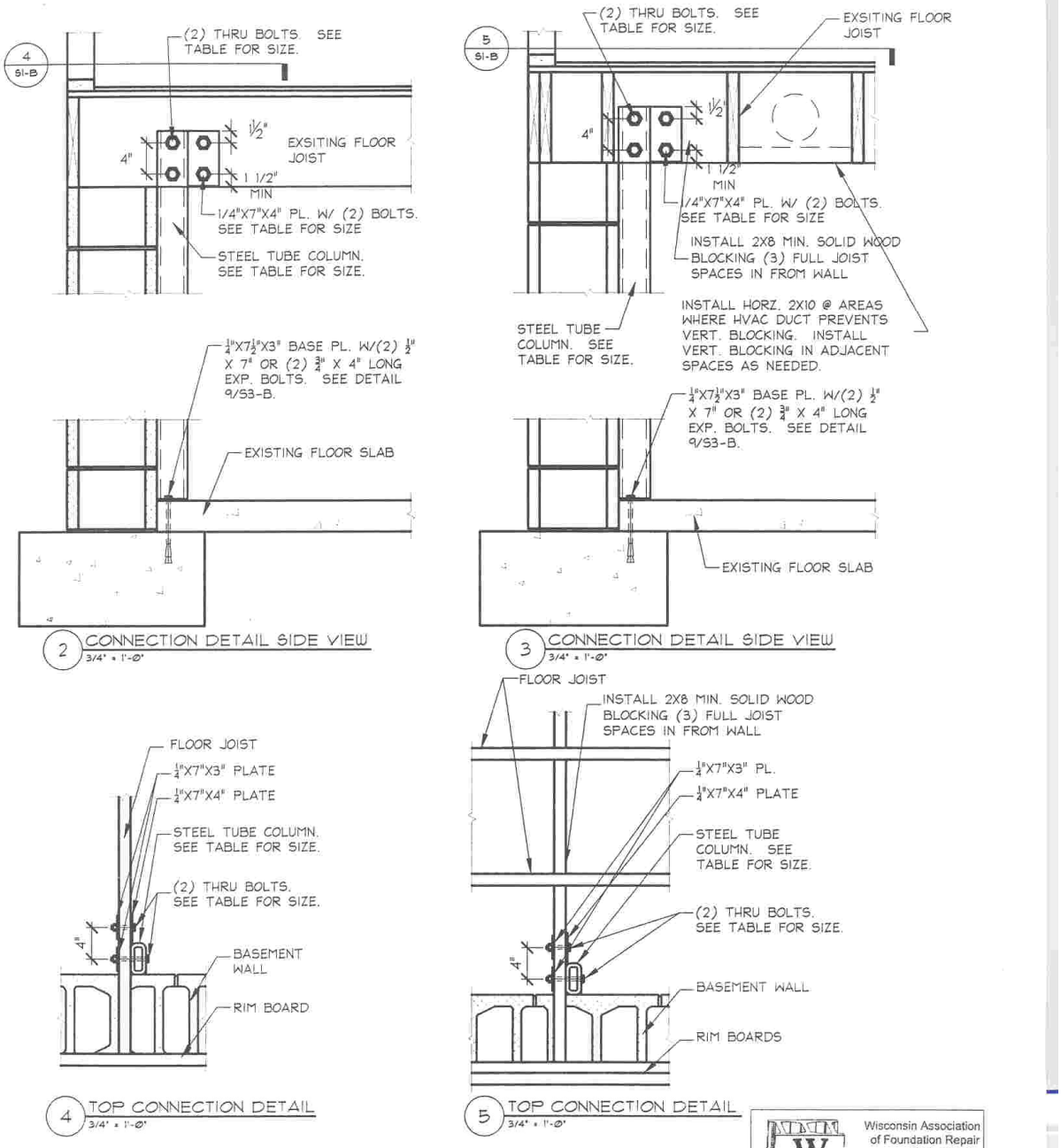

TITLE: 4 Bolt Top & Bottom Connection Details	
SHEET: S2-B, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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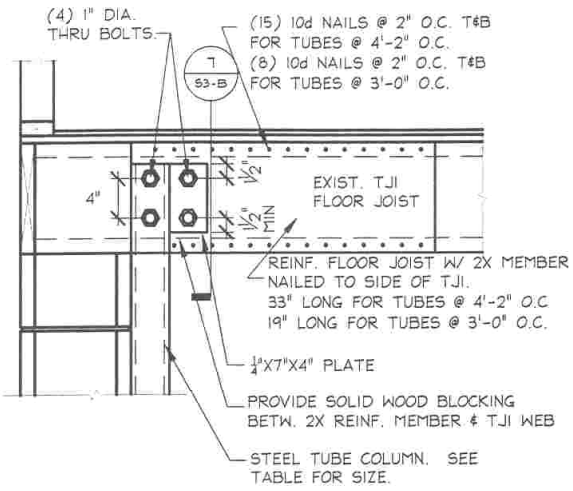
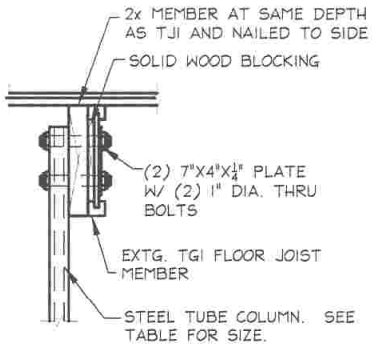
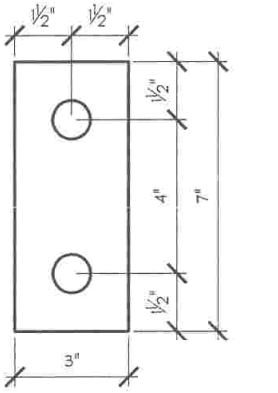


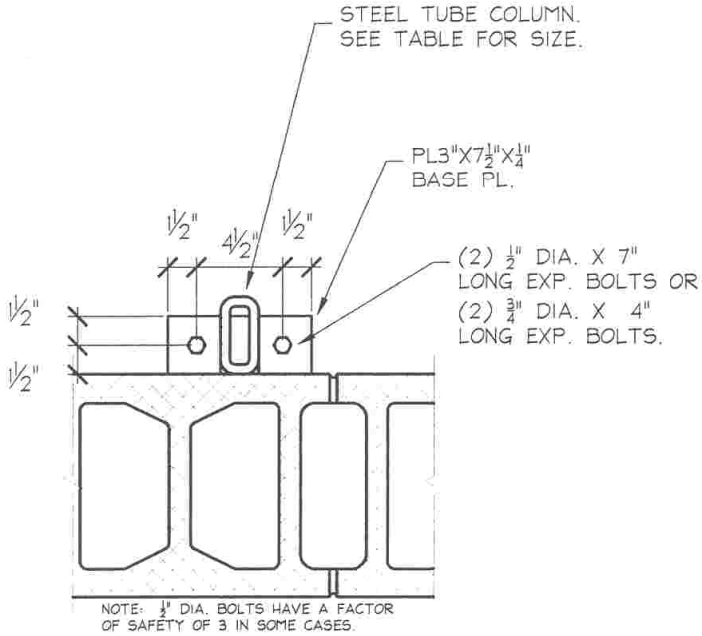
6 TJI CONNECTION DETAIL SIDE VIEW
3/4" = 1'-0"



7 TJI CONNECTION DETAIL SECTION
3/4" = 1'-0"



8 TOP PLATE DETAIL
3" = 1'-0"



9 BOTTOM CONN. DETAIL
1 1/2" = 1'-0"

TITLE: 4 Bolt Alt. Top Connection W/ Double Floor Joist	
SHEET: S3-B, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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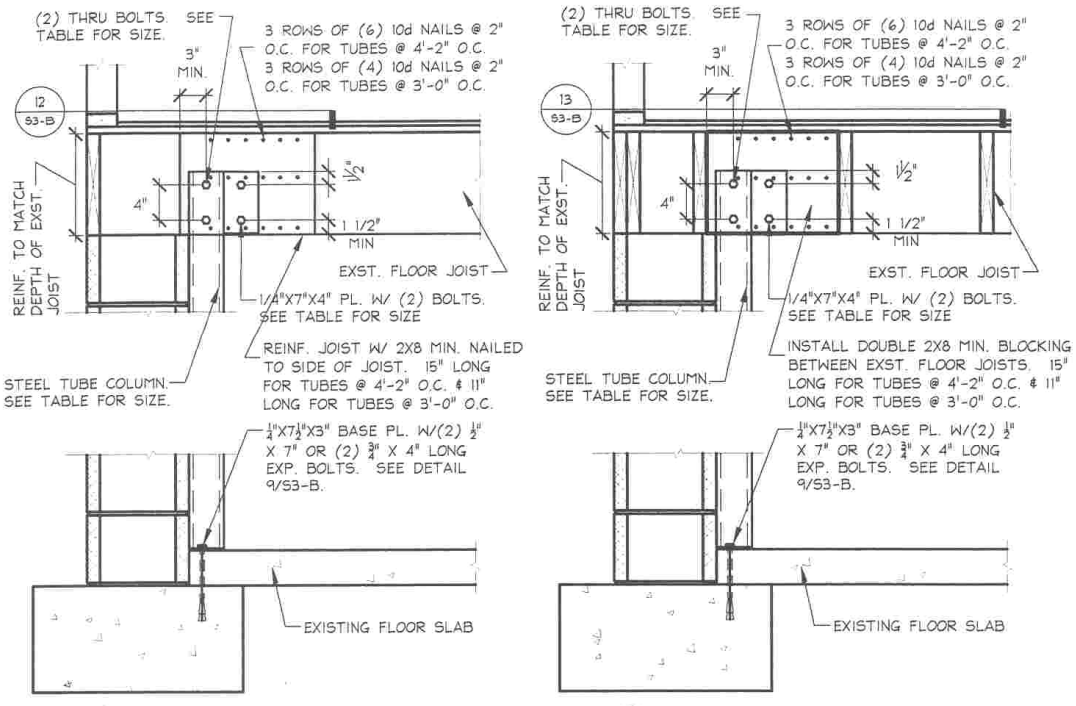

TITLE: 4 Bolt Alt. Top Connection W/ Double Floor Joist	
SHEET: S4-B, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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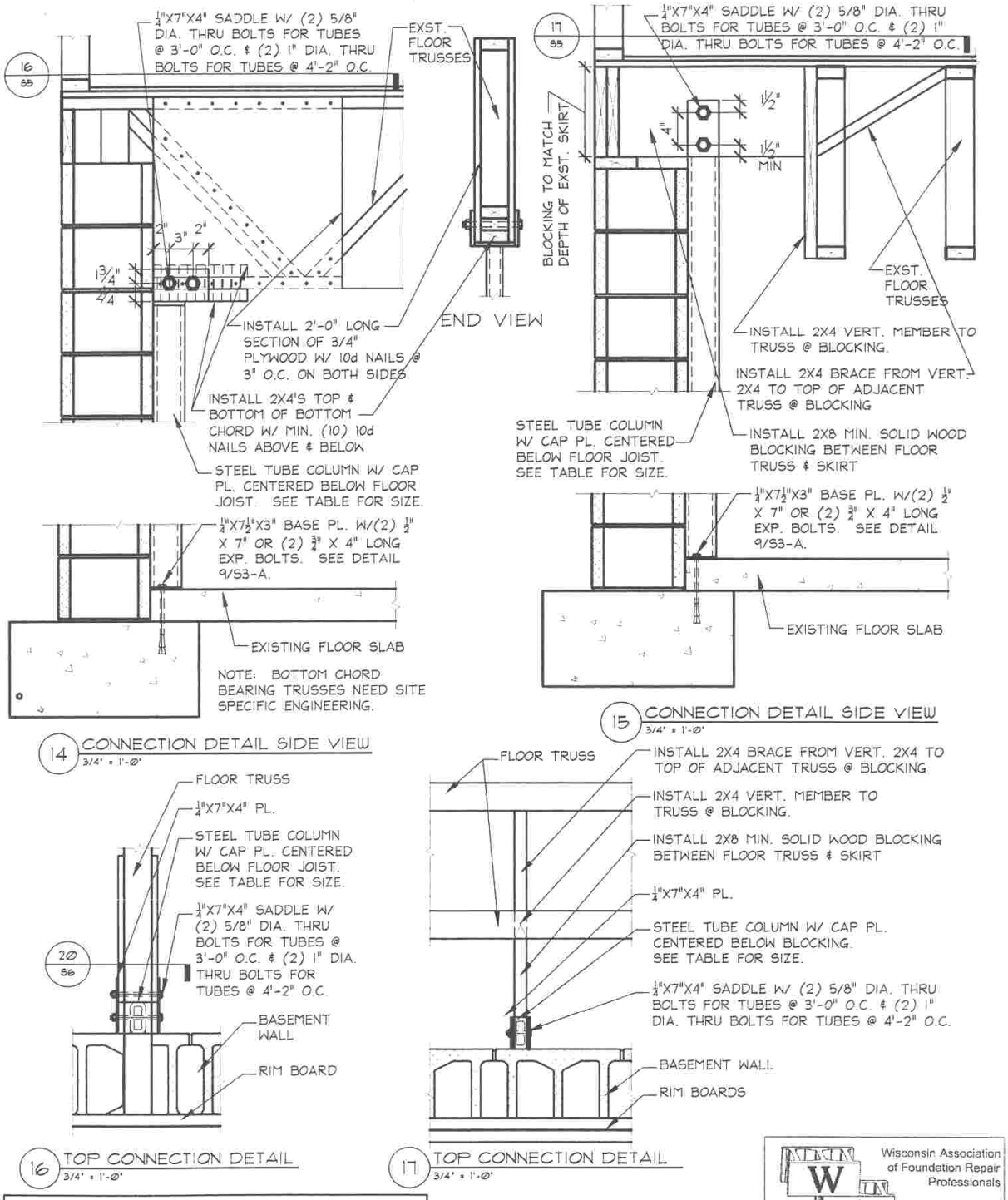

TITLE: Alt. Top Connection W/ Floor Trusses	
SHEET: S5, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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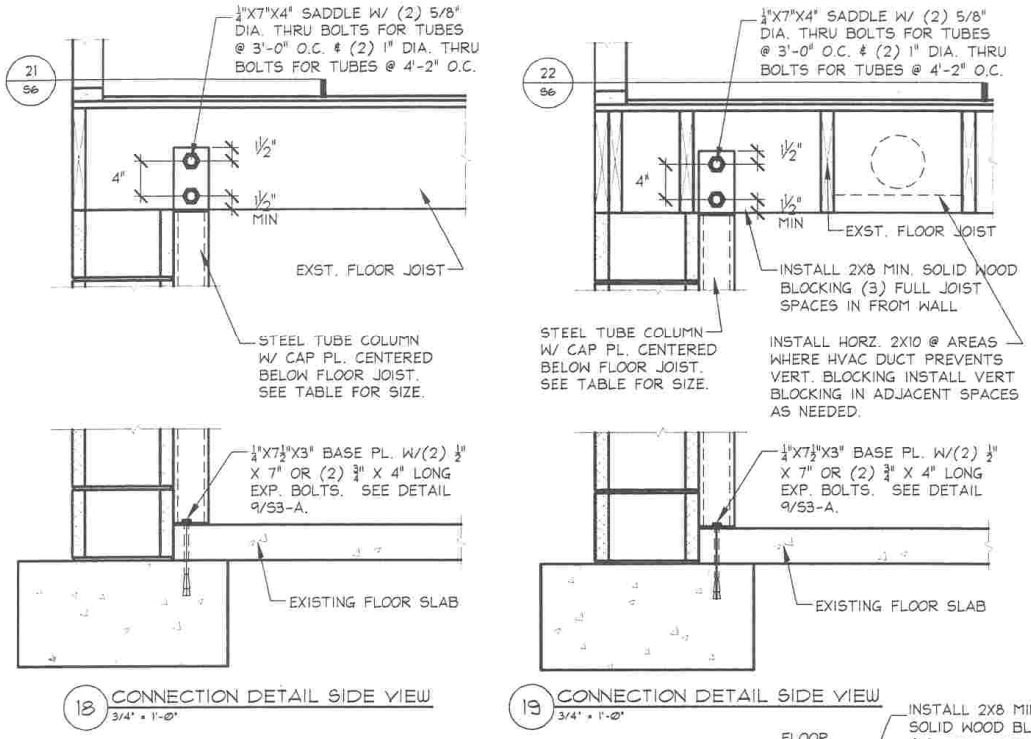

TITLE: Alt. Top Connection W/ Top Saddle	
SHEET: S6, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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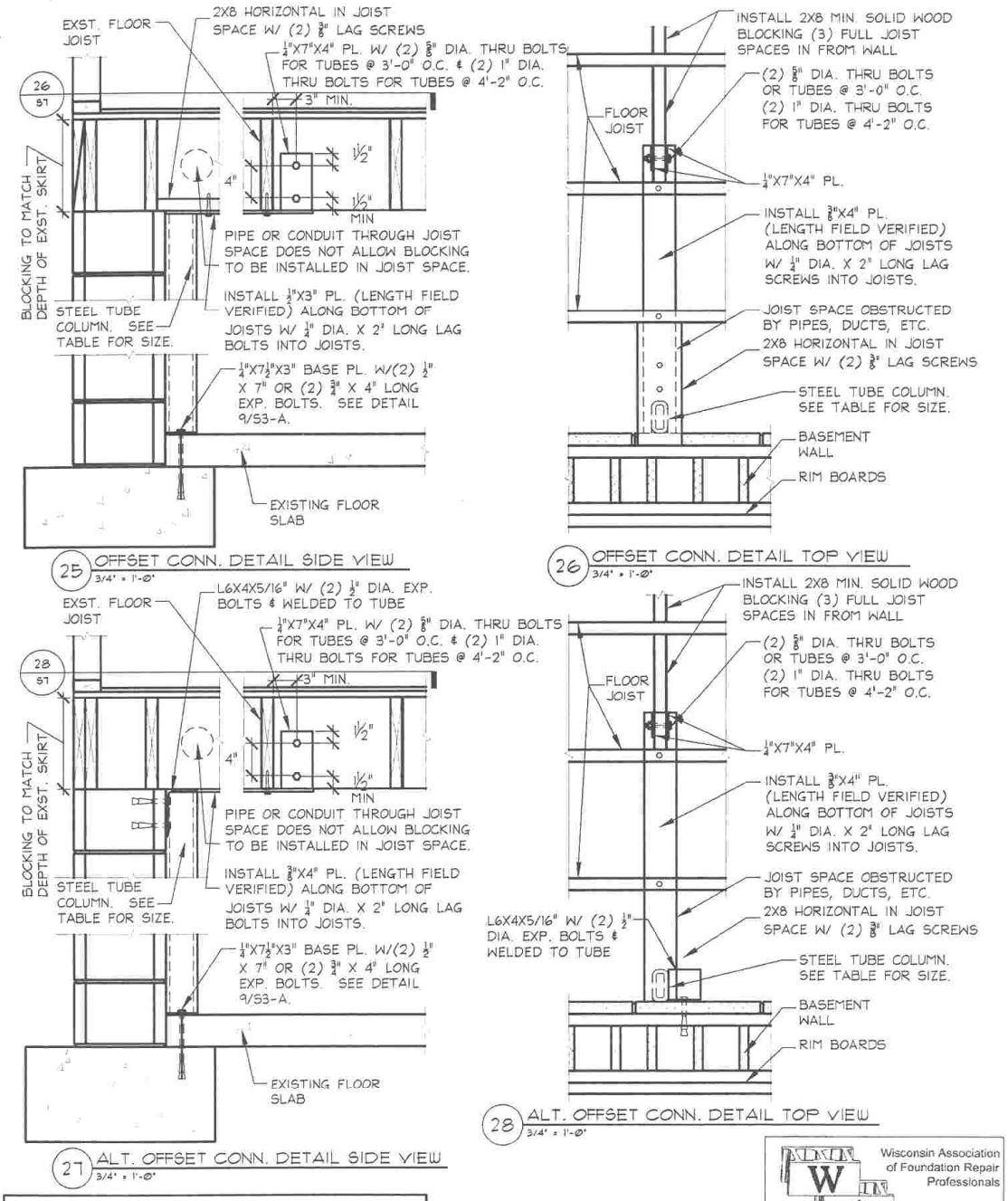

TITLE: Misc. Repair Details	
SHEET: S7, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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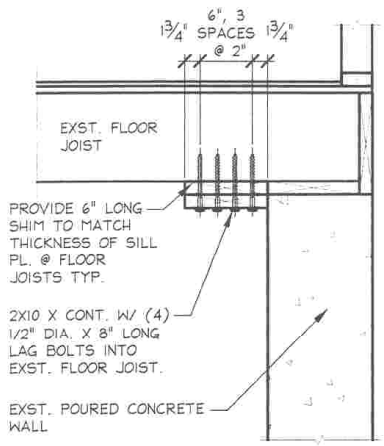
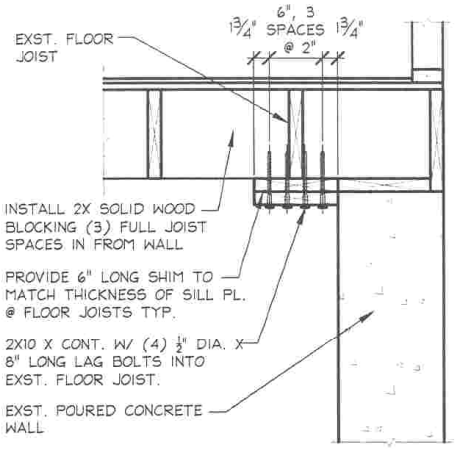
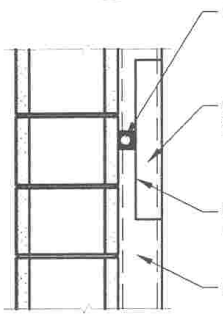


29 FLOOR JOIST CONNECTION DETAIL
3/4" = 1'-0"



30 FLOOR JOIST CONNECTION DETAIL
3/4" = 1'-0"

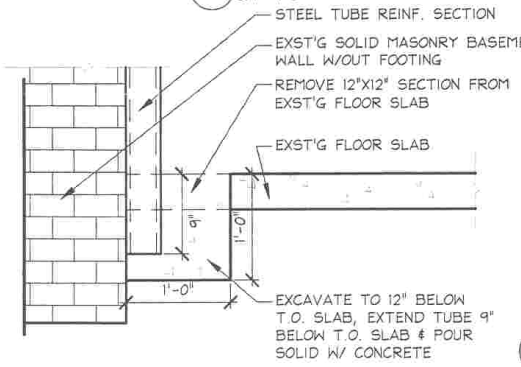


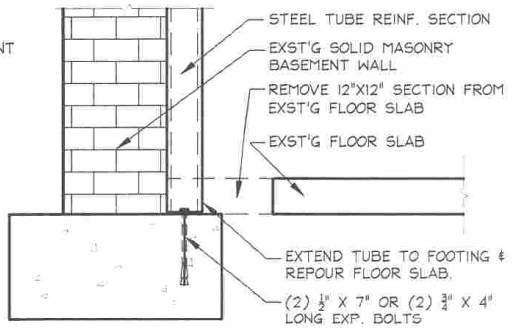
STEEL TUBE REINFORCING AROUND OBSTRUCTIONS

WALL HT.	WALL REINF. *	SPACING	REINFORCING PLATES
10 COURSES (6'-10")	HSS 5"X2"X3/16"	3'-0"	(2) PL¼"X3"X18"
	HSS 5"X2"X3/16"	4'-2"	(2) PL7/16"X3"X18"
11 COURSES (7'-6")	HSS 5"X2"X3/16"	3'-0"	(2) PL⅜"X3"X18"
	HSS 6"X2"X3/16"	4'-2"	(2) PL¼"X4"X18"
12 COURSES (8'-2")	HSS 5"X3"X1/4"	3'-0"	(2) PL½"X3"X18"
	HSS 6"X3"X1/4"	4'-2"	(2) PL5/16"X4"X18"

* 2X4 TUBES CAN BE USED IF NOTCH IS LESS THAN OR EQUAL TO 1"

31 TUBE REINFORCMENT AROUND OBSTRUCTIONS
3/4" = 1'-0"





33 WALL REINF. BOTTOM CONNECTION TO FTG
3/4" = 1'-0"

32 WALL REINF. BOTTOM CONNECTION W/O FTG
3/4" = 1'-0"

TITLE: Misc. Repair Details	
SHEET: S8, Appendix A	DRAWN: Jim Jendusa
DATE: 3/26/03	REVISION: 01/08/08

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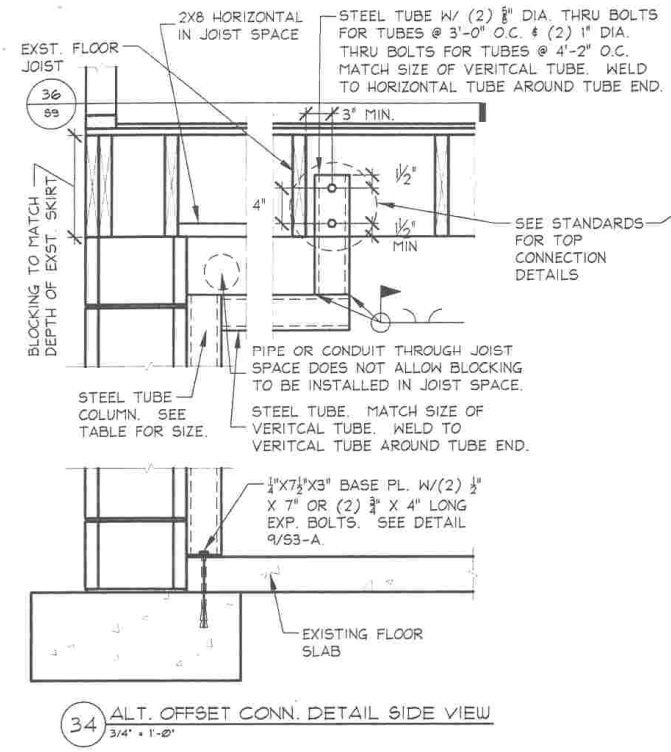
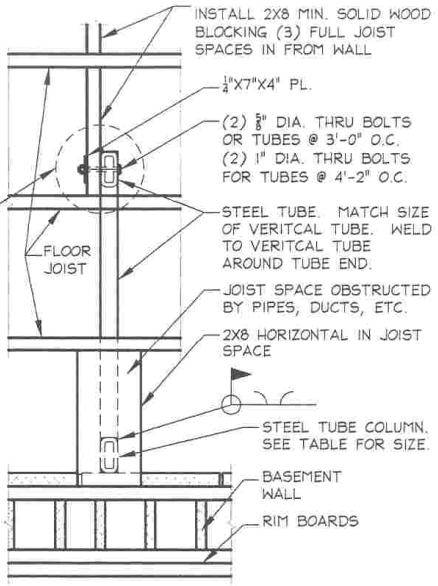
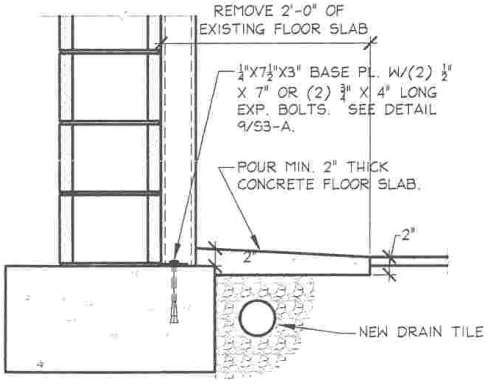


34 ALT. OFFSET CONN. DETAIL SIDE VIEW
3/4" = 1'-0"



35 ALT. OFFSET CONN. DETAIL TOP VIEW
3/4" = 1'-0"



36 NEW DRAIN TILE @ THIN SLAB
3/4" = 1'-0"

TITLE: Misc. Repair Details	
SHEET: S9, Appendix A	DRAWN: Jim Jendusa
DATE: 01/08/08	REVISION:

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262-827-5008

LIMITATIONS OF APPROVAL

The **Comm** limitation requirements below are in accordance with the current **Wisconsin Uniform Dwelling Code (UDC), for 1- & 2-family dwellings:**

- **Soil Lateral Loads:** The engineered foundation products shall be installed in accordance with the foundation requirements of **s. Comm 21.18(1)(c).**
- **Masonry Foundation Walls:** The engineered foundation products shall be installed in accordance with the structural requirements of **s. Comm 21.18(3)(b).**
- **Floor Design:** The engineered foundation products shall be installed in accordance with the floor design requirements of **s. Comm 21.19** and this evaluation.
- **Concrete Floors:** The engineered foundation products shall be installed in accordance with the concrete floor requirements of **s. Comm 21.20** and this evaluation.
- **Precast Concrete Floors:** The engineered foundation products shall be installed in accordance with the precast concrete floor requirements of **s. Comm 21.21** and this evaluation.

The **IBC** requirements below in accordance with the current **Wisconsin Amended ICC Code:**

- **Soil Lateral Loads:** The engineered foundation products shall be installed in accordance with the soil lateral load requirements of **s. IBC 1610.1** and this evaluation.
- **Soils and Foundations:** The engineered foundation products shall be installed in accordance with the soil and foundation requirements of **s. IBC 1801** and this evaluation.
- **Foundation and Soils Investigation:** The engineered foundation products shall be installed in accordance with the foundation and soil investigation requirements of **s. IBC 1802** and this evaluation.
- **Footings and Foundations:** The engineered foundation products shall be installed in accordance with the footing and foundation requirements of **s. IBC 1805** and this evaluation.
- **Anchorage to Concrete—Allowable Stress Design:** The engineered foundation products shall be installed in accordance with the anchorage to concrete—allowable stress design requirements of **s. IBC 1910.1** and this evaluation.
- **Bolting:** The engineered foundation products shall be installed in accordance with the bolting requirements of **s. IBC 2204.2** and this evaluation.
- **Structural Steel:** The engineered foundation products shall be installed in accordance with the structural steel requirements of **s. IBC 2209.1** and this evaluation.
- **Wood:** The engineered foundation products shall be installed in accordance with the general wood requirements of **s. IBC 2301.1** and this evaluation.
- **General Construction Requirements:** The engineered foundation products shall be installed in accordance with the general construction requirements of **s. IBC 2304** and this evaluation.
- **Allowable Stress Design:** The engineered foundation products shall be installed in accordance with the allowable stress requirements of **s. IBC 2306** and this evaluation.
- **Conventional Light-Frame Construction:** The engineered foundation products shall be installed in accordance with the conventional light-frame construction requirements of **s. IBC 2308** and this evaluation.

This approval will be valid through December 31, 2013, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The product approval is applicable to projects approved under the current edition of the applicable codes. This approval may be void for project approvals made under future applicable editions. The Wisconsin Building Product Evaluation number must be provided when plans that include this product are submitted for review.

DISCLAIMER

The department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Revision Date:
Approval Date: August 12, 2008 By: _____

Lee E. Finley, Jr.
Product & Material Review
Integrated Services Bureau